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ABSTRACT

While it is widely recognized that comprehension monitoring is an important reading comprehension ability, effective methods for teaching readers to recognize and overcome various comprehension obstacles have not yet been conclusively identified. To determine if microcomputers could be used to teach students to overcome such obstacles, 41 fourth grade students were randomly assigned to groups in a Solomon four-group design. The four groups were (1) a control group that received no treatment and that did not complete the Real World Reading Test (RWRT) as a pretest; (2) a control group that received no treatment, but that did complete the RWRT; (3) an experimental group that did not complete the RWRT as a pretest; and (4) an experimental group that did. Students in all groups took the RWRT as a posttest, as well as the Gates-MacGinitie reading comprehension test as a pretest. The students in the experimental groups worked at microcomputers using materials especially designed to teach comprehension monitoring, while the students in the control groups were not exposed to microcomputer instruction. Results indicated that the treatment was minimally effective. (FL)

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TEACHING COMPREHENSION-MONITORING WITH MICROCOMPUTERS

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ABSTRACT

It is widely recognized that comprehension monitoring is an important reading comprehension ability. However, effective methods for teaching readers to recognize and overcome various comprehension obstacles have not yet been conclusively identified. The present study investigated the use of microcomputers to teach students how to overcome six obstacles to comprehension. The study's 41 subjects were randomly assigned to the groups in a Solomon four-group design. The results indicated that the treatment was minimally effective. The discrepant findings in studies attempting to develop comprehension monitoring skills are interpreted from the viewpoint that schooling may tend to foster passive reading. It is noted that the comprehension-monitoring construct will ultimately benefit practice only if effective ways to facilitate development of these skills can be identified.

Comprehension monitoring "entails keeping track of one's ongoing comprehension success, ensuring the process continues effectively, and taking remedial steps when necessary" (Baker & Brown, 1980, p. 1). Many authors agree that comprehension monitoring is critical to effective reading (Baker & Anderson, 1982; Brown, 1980; Piaget, 1926; Winograd & Johnston, 1980), and attempts have been made to determine what factors lend themselves to the development of comprehension monitoring skills. Research has shown that age (Brown, 1980; Clay, 1973; Markman, 1977; Pace, 1981), learning disabilities (Katsonis & Paterson, 1980), and cognitive style (Goodenough, 1976; Kagan, Moss & Sigel, 1963; Spiro & Tirre, 1980) are among the factors which influence comprehension monitoring success. Several reviews of the literature on comprehension monitoring are available and provide indepth treatment of the subject (Anderson, 1982; Brown, Bransford, Ferrara & Campione, 1982; Kendall & Mason, 1982; Moore, 1982; Pitts, 1983).

A variety of methods have been employed to study comprehension monitoring phenomena. One technique employs interview or self-report procedures (Olshavsky, 1976-77; Strang & Rogers, 1965). A second approach employs recordings of spontaneous self-corrections during oral reading (Clay, 1973; Danks & Fears, 1980). Cloze procedures have also been used to determine reader strategy (DiVesta, Haywood & Orlando,

1979). Another technique uses error detection methods (Baker, 1979; Winograd & Johnston, 1980). For example, Baker and Anderson (1982) used computers to study the error detection skills of college students.

The investigation of the uses of microcomputers in education is itself a burgeoning field of study. The proliferation of microcomputers in classrooms, as evidenced by the 96,000 or more micros already in use in American schools (Weiss, 1983), makes such research both timely and feasible. Johnson (1982a) has succintly outlined the many benefits realized by conducting microcomputer-administered research: (1) sequences of experiments in which one or a few program factors at a time are altered are simple to conduct with microcomputers; (2) observation and recording of responses can be done accurately and unobtrusively; (3) experimenter presence and thus demand characteristics can be reduced or eliminated; (4) random assignment of subjects to conditions can be left to the computer itself; (5) random presentation of experimental material can be handled by the computer; and (6) administration time and paperwork can be reduced greatly since all data are stored on diskettes, and multiple copies of experimental materials can be made quickly from the original. One additional advantage to this application, not mentioned by Johnson, is that children are usually motivated to participate in computer-related activities.

However, this is not to say that microcomputer-administered research is without drawbacks. Johnson (1982a) notes that the time and level of training required to construct computer programs can be difficult to acquire, and that hardware access can also present difficulties. Still, microcomputer-assisted research does on balance seem to offer some noteworthy advantages.

Given the many positive features of using micros in research, surprisingly little literature exists on experiments conducted in this manner. However, there are at least two examples of reading research in which computers were employed. Johnson (1982b) used microcomputers to compare the effectiveness of vocabulary acquisition techniques. Strong (1981) investigated programmed reading instruction and motivation. It is also surprising that, while educational software availability is increasing rapidly, reading-related computer programs continue to be primarily of a drill-and-practice nature (Henney, 1982) and have little to do with the higher-level comprehension skills that most researchers believe are most critical to successful reading.

Thus, the present study was conducted to investigate the use of microcomputer software and hardware to teach comprehension monitoring skills to elementary school children. As noted previously, it has been widely recognized that

comprenhension monitoring is an important aspect of reading processes. However, this knowledge will be of little practical benefit unless effective methods for teaching comprehension monitoring skills can be identified. The present study was conducted using software developed by the authors for a previous study (Pitts, Thompson & Gipe, 1983). The previous study utilized an experimental design in which control subjects received a "placebo" microcomputer instructional activity involving reading. No statistically significant experimental effects were identified in the previous study. The present study was conducted to determine whether the previous result was an artifact of both experimental and control groups having been exposed to reading-related microcomputer activities. In the present study the control subjects were not exposed to microcomputer activities during the investigation.

Method

Subjects

The subjects in the present study were 41 fourth-grade students enrolled in a private elementary school in the southern United States. All subjects were judged by their teachers to be competent decoders. The subjects had little if any previous exposure to microcomputers.

Instrumentation

In order to maximize the external validity of the experiment, the dependent variable (reading comprehension) was measured using an instrument developed for the purposes of a previous study (Pitts, Thompson & Gipe, 1983). The Real World Reading Test (RWRT) employs reading passages selected from various commonly used textbooks that were not in use in the school attended by the subjects in the present inquiry. The RWRT includes 11 passages selected on the basis of three criteria: (1) a passage must contain at least one of the comprehension obstacles which the experimental students would be trained to overcome, (2) a passage must be typical of materials students normally encounter in textbooks, and (3) a passage must be either expository or narrative in nature. Following the passages were a total of 19 textually-explicit questions, 22 textually-implicit questions, and 19 scriptually-implicit questions. These item types were selected to represent the elements in the reading comprehension question-taxonomy proposed by Pearson and Johnson (1978). The questions were answered in writing. The RWRT was presented to the subjects in booklet form, and the order of the passages was randomized.

Procedure

The experimental computer protocols developed to teach comprehension monitoring skills were developed based on a model proposed by Collins and Smith (1980). Six typical

obstacles to comprehension at the word or sentence level were embedded in 24 different passages used only for training purposes. All the passages were six sentences long and had a fourth-grade readability level as determined by Fry's (1977) readability formula. The passages were all either expository or narrative in nature. The obstacles all occurred in the first half of each passage.

When the experimental subject was presented with a comprehension obstacle, a flashing message suggesting possible remedies was also presented on the computer screen. For example, after the sentence "The little girl was sitting on a blue guagga" the experimental subjects immediately saw the flashing message, "Did you see a new word? Read the next line and try to get the meaning."

The programs required the experimental subjects to make discrete choices about how to manipulate passage presentation. The presentation of each passage began with the presentation of only the first sentence in the passage. Throughout the reading of the passage students could then choose among four options: (1) go on to the next line of text; (2) return to the previous line; (3) review all previous lines; or (4) view all the remaining text. After each passage was presented, the subjects saw five questions regarding the passage. The questions were either textually explicit,

textually implicit, or scriptually implicit. After the students indicated their answers to these questions, they received feedback in the form of presentation of possible correct answers on the computer's video screen.

A Solomon four-group design was employed. The four randomly-assigned groups included: (1) control-group subjects who received no treatment whatsoever and who did not complete the RWRT as a pretest (n = 10); (2) control-group subjects who received no treatment and who did complete the RWRT as a pretest (n = 11); (3) experimental subjects who did not complete the RWRT as a pretest (n = 10); and (4) experimental subjects who did complete the RWRT as a pretest (n = 10). All subjects also completed the RWRT as a posttest. All subjects also took the Gates-MacGinitie reading comprehension test prior to the initiation of the experiment; scores on this test wereused as a covariate in the analysis of the study's results.

Results

The reliability of the data generated by the RWRT in the present study was investigated by computing alpha reliability. The reliability coefficient associated with the posttest administration was .84. The data were deemed reliable enough to support valid conclusions for the purposes of the study.

Table 1 presents the cell, group, and grand means associated with the 2x2 design of the study. Table 2 presents test statistics calculated for the various hypotheses in the study.

INSERT TABLES 1 AND 2 ABOUT HERE.

Discussion

Whenever results are statistically non-significant, at least two possibilities should be considered prior to developing substantive interpretations of results. First, the reliability of the measurement must be evaluated, since systematic effects simply cannot be detected with unreliable or unsystematic measurement. However, as noted previously, the RWRT was considered to be sufficiently reliable for the purposes of the investigation.

Second, an evaluation of power against making a Type II error must be considered. As Carver (1978) has explained in some detail, statistical significance and power are both basically functions of sample size. The educational significance of results must also be carefully considered, especially since statistical significance is an artifact of n-size. The Table 1 means suggest that, as expected, the experimental group that completed the pretest did have a somewhat higher posttest mean than did the other groups in the design.

However, the means are very similar, and it is especially noteworthy that the means differ no more than about one-third of a standard deviation from each other--an amount that many researchers would regard as minimal. This result suggests that statistical significance could have been realized with a larger sample size (as is always the case), but that the treatment effects do not appear to be educationally significant. Thus a substantive interpretation of the failure to reject the null hypothesis regarding treatment effects seems warranted.

As noted previously, the literature does indicate that comprehension monitoring is an important reading comprehension skill. Yet it is not clear how these skills can be effectively taught. For example, Markman (1979) found that warning sixth-graders about text inconsistencies did facilitate ability to identify textual obstacles to comprehension. But Baker (1979) found that warning college students about passage anomalies did not improve error detection. Winograd and Johnston (1980) also encountered difficulties in alerting their subjects, sixth-graders, about how to deal with textually anomalous sentences.

These findings are especially noteworthy since studies reporting statistically significant results are disproportionately more likely to be published, due to the

confusion of some potential authors and some editorial reviewers regarding the meaning of statistical significance. For example, Glass, McGaw and Smith (1981, pp. 66-67) discuss 11 major meta-analytic studies and note that journals are substantially more likely to report statistically significant results than are either books are dissertations. Nor are these differences a function of rigor of design in journal as opposed to other outlets (Smith, Glass, & Miller, 1980). Studies reporting statistically non-significant results, if (and olny if) they involve sufficient protection against measurement and Type II error, also add to a knowledge base by indicating that some methods may not be effective, or ultimately by suggesting when and for whom various methods are effective.

Some researchers (Wolf, King & Huck, 1968) have even suggested that schools have traditionally taught students to be passive readers, since children are often told to master syntax and grammar prior to focusing on critical or reflective reading. Thus Goodman (1976) argued that critical reading is not taught at all in schools. Schallert and Kleiman (1979) suggest that teachers often monitor students' comprehension for them, thus fostering passive reading. Put differently, these viewpoints suggest that some forms of schooling may make children resistant to the sorts of training investigated in the present study.

Of course, no single study or even series of several studies can conclusively establish whether a skill is important to cognitive processes or whether that skill, if important, can be practically developed in given ways. Findings become conclusive only when a variety of studies identify consistent results or when inconsistencies can be reconciled. The present study suggests the importance of continuing efforts to develop theory to explain how discrete comprehension monitoring skills can be effectively taught.

The present study investigated the use of microcomputer-based instruction intended to teach fourth-graders to recognize and overcome six types of comprehension obstacles. The training was conducted over the course of several weeks. Perhaps experiences of an even longer and more intensive nature are required to overcome student resistance to reading more critically and reflectively. This possibility remains to be explored in further research.

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Table 1
Cell, Group, and Grand Means

Experimental Group	Pretest Condition: No Pretest	Pretest	Group
Control	42.00 (SD=5.6) (n=10)	43.45 (SD=7.2) (n=11)	42.76 (SD=6.4) (n=21)
Experimental	41.60 (SD=9.4) (n=10)	44.30 (SD=3.8) (n=10)	42.95 (SD=7.1) (n=20)
Group	41.80 (SD=7.5) (n=20)	43.86 (SD=5.7) (n=21)	42.85 (SD=6.7) (n=41)

Note: The effect size (Glass, McGaw & Smith, 1981, p. 113) for the experimental, no pretest condition was negative. The effect size statistic for the experimental, pretest condition was .41 ((44.3 - 42.0)/5.6); the effect size parameter estimate was .38 (.41 x .92 correction factor).

Table 2
ANCOVA Results

Effect	Sum of Squares	df	Mean Square	F
Covariate				
Comprehension	797.44	1	797.44	32.23*
Main Effects				
Experimental Group	13.63	1	13.63	<1
Pretest Group	7.82	1	7.82	<1
Two-Way Interaction	64.49	1	64.49	2.61
Residual	890.78	36	24.74	
Total	1775.12	40		

$p < .05$